APPENDIX 16.0

PALEOTOLOGICAL RESOURCES REPORT

PALEONTOLOGICAL INVENTORY REPORT

WILDOMAR COMMONS AT HIDDEN SPRINGS PROJECT

City of Wildomar

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1.0 EXECUTIVE SUMMARY

This Paleontological Inventory Report was prepared by Paleo Solutions, Inc. (Paleo Solutions) under contract to HELIX Environmental Planning (HELIX). The purpose of this study is to identify potential impacts to paleontological resources resulting from construction of the Wildomar Commons at Hidden Springs Project (Project). All work was conducted in compliance with the California Environmental Quality Act (CEQA), state and local regulations, and best practices in mitigation paleontology (Murphey et al., 2019).

The Project consists of construction of a commercial development on undeveloped parcels near Interstate 15 (I-15) in the City of Wildomar, Riverside County, California. The paleontological assessment conducted for the Project consisted of an analysis of existing data, which included a geologic map review, a literature and online database review, and a museum record search from the Western Science Center (WSC). The analysis of existing data was supplemented with a pedestrian field survey. The results of the analysis of existing data and the pedestrian field survey were compiled to determine the potential impacts to scientifically significant paleontological resources from construction activities associated with the Project.

Based on geologic mapping by Kennedy and Morton (2003) and Morton and Miller (2006), the Project area is underlain by Pleistocene-age Pauba Formation, Sandstone Member (Qps) and Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws). According to the literature and online database review and museum record search results from the WSC, no fossil localities have been recorded within the bounds of the Project area; however, several fossil localities have been recorded in the vicinity of the Project area. The pedestrian field survey conducted on August 15, 2019, confirmed the presence of the Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws) within the Project area, but the Pleistocene-age Pauba Formation, Sandstone Member (Qps) was not observed. The pedestrian field survey also confirmed the presence of unmapped Recent artificial fill/previously disturbed (e.g., disked) sediments (af) at the surface of the Project area. No fossil localities were observed or recorded during the pedestrian field survey.

The Bureau of Land Management (BLM) Potential Fossil Yield Classification (PFYC) system (BLM, 2016) was used to evaluate the paleontological potential of the geologic units within the Project area. Pleistocene-age Pauba Formation, Sandstone Member (Qps) and Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws) have a high and moderate paleontological potential (PFYC 4 and 3), respectively. Unmapped Recent artificial fill/previously disturbed sediments (af) have low paleontological potential (PFYC 2).

Project excavations may extend several feet below the current ground surface within the Project area. The Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws) was observed in the Project area during the field survey. Additionally, the contact between the low paleontological potential unmapped Recent artificial fill/previously disturbed sediments (af) and the high potential Pleistocene-age Pauba Formation, Sandstone Member (Qps) is likely at shallow depth. Therefore, grading and other earthmoving activities may potentially result in significant adverse direct impacts to paleontological resources throughout the entirety of the Project area.

Based on the potential for Project excavations to impact significant paleontological resources, full-time monitoring is recommended during ground-disturbing activities in geologic units of moderate to high paleontological potential. Prior to construction, a Qualified Paleontologist should be retained and a Paleontological Resources Impact Mitigation Program (PRIMP) should be prepared that outlines paleontological mitigation and fossil discovery procedures. Any subsurface bones or potential fossils that are unearthed during construction should be evaluated, recorded, and reported by a Qualified Paleontologist, and, if significant, curated at the WSC or another appropriate repository.

2.0 INTRODUCTION

This Paleontological Inventory Report was prepared by Paleo Solutions under contract to HELIX. The purpose of this study is to identify potential impacts to paleontological resources resulting from construction of the Wildomar Commons at Hidden Springs Project. All work was conducted in compliance with CEQA, state and local regulations, and best practices in mitigation paleontology (Murphey et al., 2019).

2.1 PROJECT DESCRIPTION AND LOCATION

The Project consists of construction of a commercial development composed of seven buildings, five detention basins, and parking areas on undeveloped parcels in the City of Wildomar, Riverside County, California (Figure 1). Current site conditions consist of disked sediments at the surface, with scattered trees and brush.

The Project is located in the City of Wildomar near I-15 and is bound by a housing development to the northwest, Hidden Springs Road to the northeast, Clinton Keith Road to the southeast, and Stable Lanes Road and an empty lot to the southwest (Figure 2). The Project area is 8.928 acres and encompasses Assessor's Parcel Numbers (APNs) 380-110-004, -009, -010, -014, and -016. The Project area is situated on Section 1 of Township 7 South and Range 4 West, on the Murrieta (1979), California U.S. Geological Survey (USGS) 7.5' topographic quadrangle (Figure 2, Table 1).

Based on geologic mapping by Kennedy and Morton (2003) and Morton and Miller (2006), the Project area is underlain by Pleistocene-age Pauba Formation, Sandstone Member (Qps) and Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws), and unmapped Recent artificial fill/previously disturbed sediments (af) were observed within the Project area during the field survey (Table 1). Holocene- and late Pleistocene-age young alluvial-valley deposits, arenaceous (Qyva), young axial-channel deposits, arenaceous (Qyaa), and young alluvial-fan deposits, arenaceous (Qyfa) and Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Conglomerate Unit (QTwc) are present within a half mile of the Project area, but are not anticipated to be impacted by Project construction. Therefore, these geologic units are not discussed in in detail in this report (Table 1).

Figure 1. Project location.

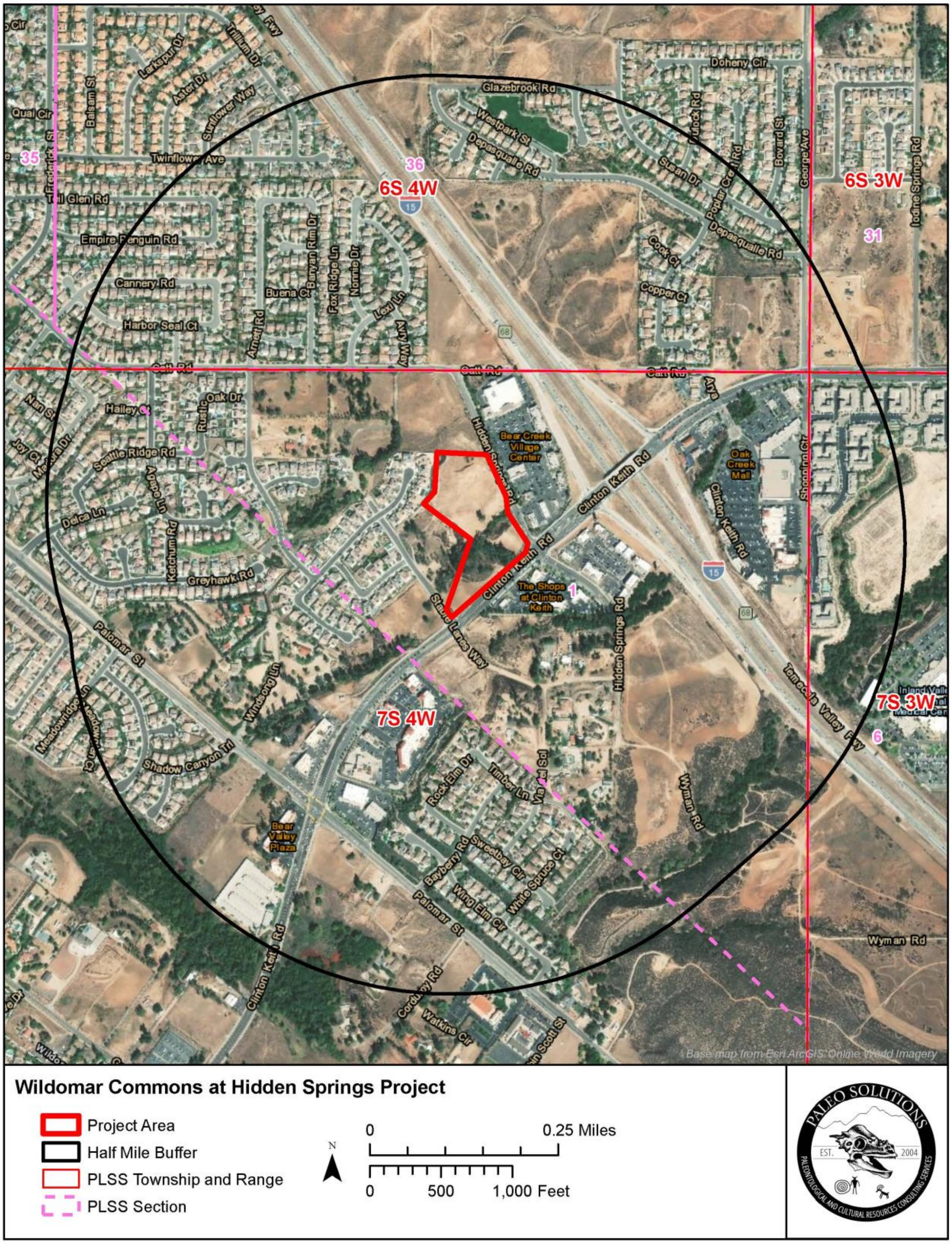

Figure 2. Project vicinity.

Table 1. Wildomar Commons at Hidden Springs Project Summary

<table>
<tr><td>Project Name</td><td colspan="4">Wildomar Commons at Hidden Springs Project</td></tr>
<tr><td>Project Description</td><td colspan="4">The Project consists of construction of a commercial development composed of seven buildings, five detention basins, and parking areas.</td></tr>
<tr><td>Project Area</td><td colspan="4">The Project is located in the City of Wildomar near I-15 and is bound by a housing development to the northwest, Hidden Springs Road to the northeast, Clinton Keith Road to the southeast, and Stable Lanes Road and an empty lot to the southwest. The Project area encompasses APNs 380-110-004, -009, -010, -014, and 0-16.</td></tr>
<tr><td>Total Acres</td><td colspan="4">Approximately 8.928 acres</td></tr>
<tr><td rowspan="2">Location (PLSS)</td><td>Quarter-Quarter</td><td>Section</td><td>Township</td><td>Range</td></tr>
<tr><td>L 2, L 3, and L 6</td><td>1</td><td>7 S</td><td>4 W</td></tr>
<tr><td>Land Owner</td><td colspan="4">Undetermined/Private</td></tr>
<tr><td>Topographic Map(s)</td><td colspan="4">Murrieta (1979), California USGS 7.5' Topographic Quadrangle</td></tr>
<tr><td>Geologic Map(s)</td><td colspan="4">Kennedy, M.P., and D.M. Morton, 2003, Preliminary Geologic Map of the Murrieta 7.5' Quadrangle, Riverside County, California: USGS, Open-File Report 03-189, scale 1:24,000.

Morton, D.M., and F.K. Miller, 2006, Geologic Map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California: USGS, Open-File Report 2006-1217, scale 1:100,000.</td></tr>
<tr><td rowspan="8">Mapped Geologic Unit(s) and Age(s)</td><td>Geologic Unit</td><td>Map Symbol</td><td>Age</td><td>Paleontological Potential (PFYC)</td></tr>
<tr><td>Unmapped artificial fill/previously disturbed sediments</td><td>af</td><td>Recent</td><td>2 (Low)</td></tr>
<tr><td>Young alluvial-fan deposits, arenaceous</td><td>Qyfa</td><td>Holocene and late Pleistocene</td><td>2 (Low)</td></tr>
<tr><td>Young axial-channel deposits, arenaceous</td><td>Qyaa</td><td>Holocene and late Pleistocene</td><td>2 (Low)</td></tr>
<tr><td>Young alluvial-valley deposits, arenaceous</td><td>Qyva</td><td>Holocene and late Pleistocene</td><td>2 (Low)</td></tr>
<tr><td>Pauba Formation, Sandstone Member</td><td>Qps</td><td>Pleistocene</td><td>4 (High)</td></tr>
<tr><td>Sandstone and Conglomerate of Wildomar Area, Sandstone Unit</td><td>QTws</td><td>Pleistocene and Pliocene</td><td>3 (Moderate)</td></tr>
<tr><td>Sandstone and Conglomerate of Wildomar Area, Conglomerate Unit</td><td>QTwc</td><td>Pleistocene and Pliocene</td><td>3 (Moderate)</td></tr>
<tr><td>Surveyor(s)</td><td colspan="4">Betsy Kruk, M.S.</td></tr>
<tr><td>Date(s) Surveyed</td><td colspan="4">August 15, 2019</td></tr>
<tr><td>Geologic Units Surveyed</td><td colspan="4">Pauba Formation, Sandstone Member (Qps); Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws)</td></tr>
<tr><td>Previously Documented Fossil Localities within the Project area</td><td colspan="4">Paleo Solutions requested paleontological record search maintained by the WSC. The WSC responded on September 5, 2019 that no paleontological resource localities are recorded within the bounds of the Project area.</td></tr>
<tr><td>Paleontological Results</td><td colspan="4">No paleontological resources were discovered during the survey. Therefore, no fossils were collected.</td></tr>
<tr><td>Disposition of Fossils</td><td colspan="4">Not applicable; no fossils observed or collected during survey.</td></tr>
</table>

Recommendation(s)	Based on the potential for Project excavations to impact significant paleontological resources, full-time monitoring is recommended during ground-disturbing activities in geologic units of moderate to high paleontological potential. Prior to construction, a Qualified Paleontologist should be retained and a Paleontological Resources Impact Mitigation Program (PRIMP) should be prepared that outlines paleontological mitigation and fossil discovery procedures. Any subsurface bones or potential fossils that are unearthed during construction should be evaluated, recorded, and reported by a Qualified Paleontologist, and, if significant, curated at the WSC or another appropriate repository.

3.0 DEFINITION AND SIGNIFICANCE OF PALEONTOLOGICAL RESOURCES

As defined by Murphey and Daitch (2007): "Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry, and physics in an effort to understand the history of life on earth. Paleontological resources, or fossils, are the remains, imprints, or traces of once-living organisms preserved in rocks and sediments. These include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains. Paleontological resources include not only fossils themselves, but also the associated rocks or organic matter and the physical characteristics of the fossils' associated sedimentary matrix.

The fossil record is the only evidence that life on earth has existed for more than 3.6 billion years. Fossils are considered non-renewable resources because the organisms they represent no longer exist. Thus, once destroyed, a fossil can never be replaced. Fossils are important scientific and educational resources because they are used to:

- Study the phylogenetic relationships amongst extinct organisms, as well as their relationships to modern groups;
- Elucidate the taphonomic, behavioral, temporal, and diagenetic pathways responsible for fossil preservation, including the biases inherent in the fossil record;
- Reconstruct ancient environments, climate change, and paleoecological relationships;
- Provide a measure of relative geologic dating that forms the basis for biochronology and biostratigraphy, and which is an independent and corroborating line of evidence for isotopic dating;
- Study the geographic distribution of organisms and tectonic movements of land masses and ocean basins through time;
- Study patterns and processes of evolution, extinction, and speciation; and
- Identify past and potential future human-caused effects to global environments and climates."

Fossil resources vary widely in their relative abundance and distribution and not all are regarded as significant. According to BLM Instructional Memorandum (IM) 2009-011, a "Significant Paleontological Resource" is defined as:

> "Any paleontological resource that is considered to be of scientific interest, including most vertebrate fossil remains and traces, and certain rare or unusual invertebrate and plant fossils. A significant paleontological resource is considered to be of scientific interest if it is a rare or previously unknown species, it is of high quality and well-preserved, it preserves a previously unknown anatomical or other characteristic, provides new information about the history of life on earth, or has an identified educational or recreational value. Paleontological resources that may be considered not to have scientific significance include those that lack provenience or context, lack physical integrity due to decay or natural erosion, or that are overly redundant or are otherwise not useful for research. Vertebrate fossil remains and traces include bone, scales, scutes, skin impressions, burrows, tracks, tail drag marks, vertebrate coprolites (feces), gastroliths (stomach stones), or other physical evidence of past vertebrate life or activities" (BLM, 2008).

Vertebrate fossils, whether preserved remains or track ways, are classified as significant by most state and federal agencies and professional groups. In some cases, fossils of plants or invertebrate animals are also considered significant and can provide important information about ancient local environments.

The full significance of fossil specimens or fossil assemblages cannot be accurately predicted before they are collected, and in many cases, before they are prepared in the laboratory and compared with previously collected fossils. Pre-construction assessment of significance associated with an area or formation must be made based on previous finds, characteristics of the sediments, and other methods that can be used to determine paleoenvironmental and taphonomic conditions.

4.0 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

This section of the report presents the regulatory requirements pertaining to paleontological resources that apply to this Project.

4.1 STATE REGULATORY SETTING

4.1.1 California Environmental Quality Act (CEQA)

The procedures, types of activities, persons, and public agencies required to comply with CEQA are defined in the Guidelines for Implementation of CEQA (State CEQA Guidelines), as amended on March 18, 2010 (Title 14, Section 15000 et seq. of the California Code of Regulations) and further amended January 4, 2013 and December 28, 2018. One of the questions listed in the CEQA Environmental Checklist is: "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?" (State CEQA Guidelines Appendix G, Section VII, Part F).

4.1.2 State of California Public Resources Code

The State of California Public Resources Code (Chapter 1.7), Sections 5097 and 30244, includes additional state level requirements for the assessment and management of paleontological resources. These statutes require reasonable mitigation of adverse impacts to paleontological resources resulting from development on state lands, and define the excavation, destruction, or removal of paleontological "sites" or "features" from public lands without the express permission of the jurisdictional agency as a misdemeanor. As used in Section 5097, "state lands" refers to lands owned by, or under the jurisdiction of, the state or any state agency. "Public lands" is defined as lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

4.2 LOCAL REGULATORY SETTING

4.2.1 County of Riverside

The Riverside County General Plan requires consideration of paleontological resources under the Multipurpose Open Space Element of the general plan (County of Riverside, 2015). The Riverside County General Plan recommendations are based on the Society of Vertebrate Paleontology (SVP) Guidelines (SVP, 2010) for the mitigation of paleontological resources. The Multipurpose Open Space Element of the general plan (County of Riverside, 2015) provides the following requirements for paleontological sensitive areas within the county:

- OS 19.6 Whenever existing information indicates that a site proposed for development has high paleontological sensitivity as shown on Figure OS-8, a paleontological resource impact mitigation program (PRIMP) shall be filed with the County Geologist prior to site grading. The PRIMP shall specify the steps to be taken to mitigate impacts to paleontological resources.

- OS 19.7 Whenever existing information indicates that a site proposed for development has low paleontological sensitivity as shown on Figure OS-8, no direct mitigation is required unless a fossil is encountered during site development. Should a fossil be encountered, the County Geologist shall be notified and a paleontologist shall be retained by the project proponent. The paleontologist shall document the extent and potential significance of the paleontological resources on the site and establish appropriate mitigation measures for further site development.

- OS 19.8 Whenever existing information indicates that a site proposed for development has undetermined paleontological sensitivity as shown on Figure OS-8, a report shall be filed with the County Geologist documenting the extent and potential significance of the paleontological resources on site and identifying mitigation measures for the fossil and for impacts to significant paleontological resources prior to approval of that department.

- OS 19.9 Whenever paleontological resources are found, the County Geologist shall direct them to a facility within Riverside County for their curation, including the Western Science Center in the City of Hemet.

4.2.2 City of Wildomar

The City of Wildomar has adopted the County of Riverside General Plan (County of Riverside, 2015). Therefore, policies pertaining to paleontological resources within the County of Riverside General Plan also apply to the City of Wildomar.

5.0 METHODS

This paleontological analysis of existing data included a geologic map review, a literature search, and a museum record search. The analysis of existing data was supplemented with a pedestrian field survey. The goal of this report is to evaluate the paleontological potential of the Project area and provide paleontological mitigation and monitoring recommendations to reduce potential impacts to paleontological resources to less than significant levels pursuant to CEQA. Senior Paleontologist Mathew Carson, M.S., performed the background research, and Mr. Carson and Paleontologist Betsy Kruk, M.S., authored this report. Ms. Kruk conducted the pedestrian field survey on August 15, 2019. Paleontological Principal Investigator Courtney Richards, M.S., performed the technical review of this report. GIS maps were also prepared by Mr. Carson.

A copy of this report will be submitted to the City and HELIX. Paleo Solutions will retain an archival copy of all Project information including field notes, maps, and other data.

5.1 ANALYSIS OF EXISTING DATA

Paleo Solutions reviewed geologic mapping of the Project area by Kennedy and Morton (2003) and Morton and Miller (2006). The literature reviewed included published and unpublished scientific papers. A paleontological records search request was submitted to the WSC. Additional record searches of online databases, such as the University of California Museum of Paleontology (UCMP) and the Paleobiology Database (PBDB), were completed by Paleo Solutions' staff.

5.2 FIELD SURVEY

The pedestrian field survey was conducted on August 15, 2019 by Paleo Solutions staff member Betsy Kruk, M.S. The paleontological survey was performed in order to determine the paleontological potential of the geologic deposits underlying the Project area. The pedestrian survey included inspection of the Project area with the majority of focus occurring in areas with native sediment exposures of geologic units mapped as moderate (PFYC 3) and high (PFYC 4) paleontological potential. This included close inspection of sediment and bedrock outcrops. Rock exposures as well as the surrounding areas were photographed and documented. During the survey, reference points and locality information were acquired using a Garmin™ GPS. Sediment and bedrock lithologies were recorded and used to better interpret the Project's paleontological potential, and thus better understand the Project's potential impact on paleontological resources.

5.3 CRITERIA FOR EVALUATING PALEONTOLOGICAL POTENTIAL

The PFYC system was developed by the BLM (BLM, 2016). Because of its demonstrated usefulness as a resource management tool, the PFYC has been utilized for many years for projects across the country, regardless of land ownership. It is a predictive resource management tool that classifies geologic units on their likelihood to contain paleontological resources on a scale of 1 (very low potential) to 5 (very high potential). This system is intended to aid in predicting, assessing, and mitigating paleontological resources. The PFYC ranking system is summarized in Table 2.

Table 2. Potential Fossil Yield Classification (BLM, 2016)

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
1 = Very Low Potential	Geologic units are not likely to contain recognizable paleontological resources.
	Units are igneous or metamorphic, excluding air-fall and reworked volcanic ash units.
	Units are Precambrian in age.
	Management concern is usually negligible, and impact mitigation is unnecessary except in rare or isolated circumstances.
2 = Low Potential	Geologic units are not likely to contain paleontological resources.
	Field surveys have verified that significant paleontological resources are not present or are very rare.
	Units are generally younger than 10,000 years before present.
	Recent eolian deposits.
	Sediments exhibit significant physical and chemical changes (i.e., diagenetic alteration) that make fossil preservation unlikely.
	Management concern is generally low, and impact mitigation is usually unnecessary except in occasional or isolated circumstances.
3 = Moderate Potential	Sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence.
	Marine in origin with sporadic known occurrences of paleontological resources.
	Paleontological resources may occur intermittently, but these occurrences are widely scattered.
	The potential for authorized land use to impact a significant paleontological resource is known to be low-to-moderate.
	Management concerns are moderate. Management options could include record searches, pre-disturbance surveys, monitoring, mitigation, or avoidance. Opportunities may exist for hobby collecting. Surface-disturbing activities may require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action could affect the paleontological resources.

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
4 = High Potential	Geologic units that are known to contain a high occurrence of paleontological resources.
	Significant paleontological resources have been documented but may vary in occurrence and predictability.
	Surface-disturbing activities may adversely affect paleontological resources.
	Rare or uncommon fossils, including nonvertebrate (such as soft body preservation) or unusual plant fossils, may be present.
	Illegal collecting activities may impact some areas.
	Management concern is moderate to high depending on the proposed action. A field survey by a qualified paleontologist is often needed to assess local conditions. On-site monitoring or spot-checking may be necessary during land disturbing activities. Avoidance of known paleontological resources may be necessary.
5 = Very High Potential	Highly fossiliferous geologic units that consistently and predictably produce significant paleontological resources.
	Significant paleontological resources have been documented and occur consistently.
	Paleontological resources are highly susceptible to adverse impacts from surface disturbing activities.
	Unit is frequently the focus of illegal collecting activities.
	Management concern is high to very high. A field survey by a qualified paleontologist is almost always needed and on-site monitoring may be necessary during land use activities. Avoidance or resource preservation through controlled access, designation of areas of avoidance, or special management designations should be considered.
U = Unknown Potential	Geologic units that cannot receive an informed PFYC assignment.
	Geological units may exhibit features or preservational conditions that suggest significant paleontological resources could be present, but little information about the actual paleontological resources of the unit or area is unknown.
	Geologic units represented on a map are based on lithologic character or basis of origin, but have not been studied in detail.
	Scientific literature does not exist or does not reveal the nature of paleontological resources.
	Reports of paleontological resources are anecdotal or have not been verified.
	Area or geologic unit is poorly or under-studied.
	BLM staff has not yet been able to assess the nature of the geologic unit.
	Until a provisional assignment is made, geologic units with unknown potential have medium to high management concerns. Field surveys are normally necessary, especially prior to authorizing a ground-disturbing activity.

6.0 ANALYSIS OF EXISTING DATA

The Project area is located within the northern part of the Peninsular Ranges Geomorphic Province along a secondary fault zone, the Wildomar Fault Zone, of the greater northwest-southeast-trending Elsinore Fault Zone (Kennedy and Morton, 2003; Harden, 2004; Morton and Miller, 2006). A geomorphic province is a geographical area of distinct landscape character, with related geophysical features, including relief, landforms, orientations of valleys and mountains, type of vegetation, and other geomorphic attributes (Harden, 2004). Attributes of the Peninsular Ranges Geomorphic Province consist of northwest-southeast-trending, fault-bounded discrete blocks, with mountain ranges, broad intervening valleys, and low-lying coast plains (Yerkes et al., 1965; Norris and Webb, 1990). Within California, the province extends approximately 125 miles from the Transverse Ranges and the Los Angeles Basin south to the Mexican border, extending southward approximately 775 miles toward to the tip of Baja California, and it is bound on the east by the right-slip San Andreas Fault Zone, the Eastern Transverse Ranges, and the Colorado Desert (Norris and Webb, 1990; Hall, 2007). Most of the geomorphic province is located offshore and includes the Santa Catalina and San Clemente islands (Hall, 2007). Topographically on the mainland, the Peninsular Ranges are steeper on the eastern slopes, where they are truncated by normal faults like the Elsinore or San Jacinto faults, and are more gradual on their western slopes toward the Pacific Ocean, similar to the topography of the Sierra Nevada (Norris and Webb, 1990; Prothero, 2017). Within the province, the highest elevations are found in the eastern-most block, with San Jacinto Peak reaching approximately 10,805 feet in elevation and various summits of the Santa Rosa Mountains averaging 6,000 feet in elevation (Norris and Webb, 1990). Westward toward the coast, elevations are less dramatic.

The pre-Phanerozoic history of the Peninsular Ranges is not represented within the province, and few locations contain rocks older than the Mesozoic (Norris and Webb, 1990), and sparse Paleozoic strata within the Peninsular Ranges is in stark contrast to the Sierra Nevada, which contains thick sections of Paleozoic rocks. The oldest pre-batholithic rocks in the Peninsular Ranges are Paleozoic in age and consist of metamorphosed remnants of a stable carbonate platform (now marble and schist) on a passive continental margin that existed along western North America at that time (Harden, 2004). Moreover, late Paleozoic limestone is present near Riverside (Norris and Webb, 1990), further supporting the presence of a shallow marine environment prior to the Mesozoic. Most of the geologic history of the Peninsular Ranges is represented by Mesozoic-age plutonic rocks and Cenozoic-age uplift, erosion, and sedimentary deposition in basins (Sylvester and O'Black Gans, 2016).

During the Triassic and Jurassic, marine sedimentary rocks composed of sandstone and shale were deposited in turbidite sequences along a submarine fan (Harden, 2004). Throughout the Jurassic and Cretaceous, the continental margin became active as the Farallon Plate, which ferried old island arcs, subducted beneath the North American Plate, creating a large pluton complex (i.e., batholith) beneath the surface that rose into the upper crust and intruded into Paleozoic and Mesozoic sedimentary and volcanic rocks (Harden, 2004; Sylvester and O'Black Gans, 2016). The large complex of batholiths resulted in the formation of the San Marcos Gabbro, Bonsall Tonalite, and Woodson Mountain Granodiorite among others in the Peninsular Ranges (Norris and Webb, 1990). Contact metamorphism from the plutons metamorphosed older sedimentary and volcanic rocks into marble, slate, schist, quartzite, gneiss, and metavolcanic rocks (Sylvester and O'Black Gans, 2016). The timing of the Peninsular Ranges Batholith is similar to that of the Sierra Nevada, ranging in age from 70 to 120 million years ago (Norris and Webb, 1990). The batholith complex originally formed south of the Mexican border but has since moved along the right-slip San Andreas Fault over the past 40 million years (Prothero, 2017). During the Late Cretaceous through the Paleogene, the Peninsular Ranges Batholith was uplifted and eroded into a broad plain, where fluvial systems transported sediments westward across the plain and onto the seafloor (Sylvester and O'Black Gans, 2016). Sedimentary rocks were deposited in a forearc basin by turbidity currents representing both deep and shallow marine and nonmarine environments, including the marine Williams, Ladd, and Rosario formations and the nonmarine Trabuco Formation, with extensive exposures in the western flank of the Santa Ana Mountains (Norris and Webb, 1990; Harden, 2004).

Throughout the Cenozoic, thick sections of sedimentary rocks were deposited in large basins, such as the Los Angeles, Imperial, and offshore basins, due to erosion (Norris and Webb, 1990). Most exposures of early Tertiary strata are restricted to the coastal margins, with a maximum thickness of approximately 4,500 feet in the Santa Ana Mountains (Norris and Webb, 1990). Most Cenozoic strata represent nonmarine depositional environments; however, approximately 600 feet of marine sediments are present near San Diego (Norris and Webb, 1990). Thick nonmarine deposits formed during the Oligocene, followed by a pause of sedimentation at the end of the Oligocene due to tectonic uplift (Norris and Webb, 1990). By the beginning of the Miocene, most of the Farallon Plate had been subducted beneath the North American Plate, and the Pacific Plate came into contact with the North American Plate (Sylvester and O'Black Gans, 2016). As the Pacific Plate slid northwest along the North American Plate, a section of forearc basin was rafted, rotated clockwise approximately 110 degrees, and carried north approximately 130 miles; while carried northward, the forearc basin was compressed and formed the Transverse Ranges located immediately north of the Peninsular Ranges (Sylvester and O'Black Gans, 2016). Additionally, movement along the San Jacinto Fault Zone, which bifurcates from the San Andreas Fault Zone in an area north of the Peninsular Ranges, occurred in the middle to late Tertiary through the Quaternary, with a right-slip and vertical motion resulting in approximately 18 miles of lateral displacement (Norris and Webb, 1990). During this time, thick accumulations of nonmarine sediments filled basins, as well as coastal and offshore areas, in the northern Peninsular Ranges during the Pliocene, with up to 7,000-foot thick sections of siltstone, sandstone, and conglomerate in the Mount Eden and San Timoteo canyons (Norris and Webb, 1990). Despite widespread volcanism elsewhere in southern California during the late Tertiary, little volcanism occurred within the Peninsular Ranges during this time (Norris and Webb, 1990). Throughout the Quaternary, fluvial and lacustrine sediments continued to fill basins within the province, with restricted volcanic and marine terrace deposits along the coast (Norris and Webb, 1990).

6.1 LITERATURE SEARCH

Based on geologic mapping by Kennedy and Morton (2003) and Morton and Miller (2006), the Project area is underlain by Pleistocene-age Pauba Formation, Sandstone Member (Qps) and Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws) (Figure 3). Although not mapped within the boundaries of the Project area, unmapped Recent artificial fill or previously disturbed sediments (af) were also observed within the Project area during the field survey (Figure 3).

6.1.1 Artificial Fill or Previously Disturbed Sediments (af)

The Project area is underlain by unmapped Recent artificial fill/previously disturbed sediments (af). These sediments were deposited during previous ground-disturbing activities. Previously disturbed sediments and artificial fill are assigned low paleontological potential (PFYC 2) at the surface using BLM (2016) guidelines since any fossil discovered in these deposits has been removed from its geologic context. However, they likely overlie older geologic units with relatively higher paleontological potential at shallow depth.

6.1.2 Pauba Formation, Sandstone Member (Qps)

According to Kennedy and Morton (2003) and Morton and Miller (2006), the Pauba Formation is Pleistocene in age and consists of very old surficial deposits of siltstone, sandstone, and conglomerate named by Mann (1955) for exposures in the Rancho Pauba area, located approximately 2 miles southeast of Temecula. The Pauba Formation consists of two informal members, an upper Sandstone Member and a lower Fanglomerate Member. The Pauba Formation, Sandstone Member (Qps) consists of brown, moderately well-indurated, cross-bedded sandstone containing sparse cobble to boulder conglomerate beds, and the Fanglomerate Member, which is not mapped within the vicinity of the Project area, consists of grayish-brown, well-indurated, poorly sorted fanglomerate and mudstone. The Pauba Formation unconformably overlies the Sandstone and Conglomerate of the Wildomar Area (see below). The Pauba Formation, Sandstone Member (Qps) is mapped within the Project area along its southern-most portions along Clinton Keith Road, as well as immediately north and adjacent to the Project area's northern boundary.

The Pauba Formation, Sandstone Member (Qps) contains an extensive variety of late Irvingtonian and early Rancholabrean fossils that are primarily mammals (Jefferson, 1991; Pajak et al., 1996; Kennedy and Morton, 2003; Morton and Miller, 2006;). According to Jefferson (1991), the Pauba Formation within Riverside County has yielded elephant (Proboscidea), mammoth (*Mammuthus* sp.), mastodon (*Mammut americanum*), horse (*Equus* sp.), tapir (*Tapirus* sp.), deer (Cervidae), bison (*Bison* sp.), camel (*Camelops* sp.), llama (*Hemiauchenia macrocephala*), artiodactyl (Artiodactyla), fox (*Vulpes* sp.), carnivoran (Carnivora), rabbit (*Sylvilagus* sp., *Sylvilagus audubonii*), rodent (*Thomomys* sp., *Thomomys bottae*, *Dipodomys* sp., *Perognathus* sp., *Reithrodontomys* sp., *Neotoma* sp., *Microtus californicus*), with similar taxa found in Pleistocene-age sediments throughout Southern California. Additionally, Pajak et al. (1996) list several vertebrate fossils from the Pauba Formation, including mammoth (*Mammuthus* sp.), mastodon (*Mammut americanum*), ground sloth (*Paramylodon harlani*), saber-toothed cat (*Smilodon fatalis*), coyote (*Canis latrans*), carnivoran (Carnivora), weasel (*Mustela* sp.), horse (*Equus* sp., *Equus bautistensis*), tapir (*Tapirus californicus*), peccary (Tayassuidae), camel (*Camelops* sp.), big horn sheep (*Ovis canadensis*), deer (*Odocoileus* sp.), pronghorn (*Antilocapra* sp., Antilocapridae), bat (Chiroptera), shrew (*Sorex* sp.), mole (Talpidae, *Scapanus* sp.), rabbit (Leporidae, *Sylvilagus* sp., *Lepus* sp.), and rodent (Sciuridae, *Thomomys* sp., *Thomomys bottae*, *Perognathus* sp., *Dipodomys* sp., *Peromyscus* sp., *Neotoma* sp., *Microtus* sp.).

The UCMP (2019) online database does not contain records for the Pauba Formation; however, it does contain several records of fossil localities from unnamed Pleistocene-age sediments throughout Southern California. From unnamed Pleistocene-age sediments within Riverside County, the UCMP (2019) contains records for plants, invertebrates, and vertebrates, such as mammoth (*Mammuthus*), rodent (Microtinae, *Microtus*, *Microtus californicus*, *Neotoma*), and tortoise (*Gopherus*). The PBDB (2019) does contain numerous records of fossil localities from the Pauba Formation of Riverside County. These fossil localities have yielded pronghorn (Antilocapridae, *Capromeryx* sp.), deer (*Odocoileus* sp.), sheep (*Ovis canadensis*), camel (*Camelops* sp., *Camelops hesternus*, *Hemiauchenia* sp., *Hemiauchenia macrocephala*), tapir (*Tapirus californicus*), horse (*Equus* sp., *Equus scotti*), mammoth (*Mammuthus* sp., *Mammuthus columbi*), mastodon (*Mammut americanum*), ground sloth (*Paramylodon* sp., *Paramylodon harlani*), saber-toothed cat (*Smilodon fatalis*), coyote (*Canis latrans*), bat (Chiroptera), rabbit (Leporidae, *Lepus* sp., *Sylvilagus* sp.), weasel (*Mustela* sp.), shrew (*Sorex* sp.), rodent (Cricetidae, *Dipodomys* sp., *Microtus* sp., *Microtus californicus*, *Neotoma* sp., Perognathinae, *Peromyscus* sp., Sciuridae, *Thomomys* sp., *Thomomys bottae*), and mole (*Scapanus* sp.) (PBDB, 2019). Additionally, the PBDB (2019) contains fossil records from unnamed Pleistocene-age sediments within the vicinity of the Project area, which have yielded mastodon (*Mammut californicus*) (Dooley et al., 2019).

Because of its fine-grained lithology and potential to yield a scientifically significant and diverse fossil fauna, the Pauba Formation, Sandstone Member (Qps) has a high paleontological potential (PFYC 4) based on BLM (2016) guidelines.

6.1.3 Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws)

Pleistocene- and Pliocene-age Sandstone and Conglomerate of the Wildomar Area, Sandstone Unit was mapped by Kennedy and Morton (2003) and Morton and Miller (2006) as immediately underlying the Project area (Figure 3). This informal geologic unit consists of a sequence of Pleistocene- and Pliocene-age sandstone, pebbly sandstone, and conglomerate located within the Wildomar Area (Morton and Miller, 2006) that is estimated to be up to 246 feet thick (Kennedy and Morton, 2003).

A Blancan to Irvingtonian age fossil vertebrate fauna has been reported from the lower portion of this unnamed sequence (Pajak et al., 1996; Kennedy and Morton, 2003; Morton and Miller, 2006). In additiona, numerous vertebrate and invertebrate fossils have been recovered from Pleistocene- to Pliocene-age geologic units of equivalent lithology and age throughout Riverside County. Pajak et al. (1996) list several vertebrate fossils from the Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws), including mammoth (*Mammuthus* sp.), mastodon (*Mammut* sp.), elephant (Proboscidea), ground sloth (*Megalonyx wheatleyi*, *Paramylodon harlani*), horse (*Equus* sp., *Equus bautistensis*), camel (Camelidae, *Camelops* sp.), llama (*Hemiauchenia* sp.), deer (Cervidae, *Odocoileus* sp.), pronghorn (Antilocapridae, *Antilocapra* sp., *Tetrameryx* sp.), peccary (*Platygonus bicalcaratus*), fox (*Vulpes macrotis*), wolf (Canidae, *Canis* sp.), coyote (*Canis latrans*), cat (Felidae), short-faced bear (*Arctodus simus*), badger (*Taxidea* sp.), weasel (*Mustela* sp.), bat (Microchiroptera), mole (*Scapanus* sp.), rabbit (Leporidae, *Hypolagus* sp., *Lepus* sp., *Sylvilagus* sp.), and rodent (Sciuridae, *Thomomys* sp., *Thomomys bottae*, Perognathinae, *Perognathus* sp., *Paraneotoma fossilis*, *Neotoma* sp., *Sigmodon* sp., *Sigmodon minor*, *Peromyscus* sp., *Prodipodomys* sp., *Dipodomys* sp., *Ondatra* sp., *Mimomys* sp., *Mimomys parvus*, *Microtus* sp., *Microtus californicus*, *Onychomys torridus*, *Eutamias* sp., *Geomys* sp., *Reithrodontomys* sp., *Coendou* sp., Cricetidae).

Although the UCMP (2019) does not contain records for unnamed geologic units, the PBDB contains several records of fossil localities from Pleistocene- to Pliocene-age unnamed sandstone units within Riverside County. According to the PBDB, these fossil localities have yielded pronghorn (Antilocapridae, *Antilocapra* sp., *Tetrameryx* sp.), deer (Cervidae, *Odocoileus* sp.), tapir (*Tapirus californicus*), peccary (*Platygonus bicalcaratus*), camel (Camelidae), llama (*Hemiauchenia* sp.), horse (*Equus* sp., *Equus scotti*), mammoth (*Mammuthus* sp.), mastodon (*Mammut* sp.), ground sloth (*Megalonyx* sp., *Paramylodon* sp., *Paramylodon harlani*), wolf (Canidae, *Canis* sp.), coyote (*Canis latrans*), fox (*Vulpes* sp., *Vulpes velox*), cat (Felidae), short-faced bear (*Arctodus simus*), rabbit (Archaeolaginae, Leporidae, *Hypolagus* sp., *Lepus* sp., *Sylvilagus* sp.), weasel (*Mustela* sp., *Mephitis* sp., *Taxidea* sp.), bat (Microchiroptera), shrew (Soricidae, *Sorex* sp.), rodent (Arvicolinae, Cricetidae, Perognathinae, Sciuridae, *Dipodomys* sp., *Erethizon* sp., *Geomys* sp., *Microtus* sp., *Microtus californicus*, *Microtus meadensis*, *Myodes* sp., *Neotamias* sp., *Neotoma* sp., *Ondatra* sp., *Onychomys torridus*, *Ophiomys parvus*, *Peromyscus* sp., *Prodipodomys* sp., *Reithrodontomys* sp., *Sigmodon* sp., *Sigmodon minor*, *Spermophilus* sp., *Spermophilus beecheyi*, *Thomomys* sp., *Thomomys bottae*, *Thomomys gidleyi*), mole (*Scapanus* sp.), bird (Aves), snake (Colubridae, Natricinae, *Crotalus* sp.), lizard (Anguidae, Iguanidae, Lacertilia, *Anniella* sp., *Eumeces* sp., *Gerrhonotus* sp., *Phrynosoma* sp., *Sceloporus* sp., *Uta stansburiana*), tortoise (*Geochelone* sp.), turtle (Emydinae, Testudines), salamander (Plethodontinae), frog (*Anura* sp., *Hyla* sp.), toad (*Bufo* sp.), and fish (*Gasterosteus aculeatus*), as well as invertebrates, such as gastropods (*Succinea* sp.) (PBDB, 2019). Pleistocene- to Pliocene-age fossils have the potential to yield significant vertebrate fossils from fine-grained sediments; however, these fossils are sporadic throughout this geologic unit. Therefore, the Pleistocene- and Pliocene-age Sandstone and Conglomerate of the Wildomar Area, Sandstone Unit (QTws) is considered to have moderate paleontological potential (PFYC 3) based on BLM (2016) guidelines.

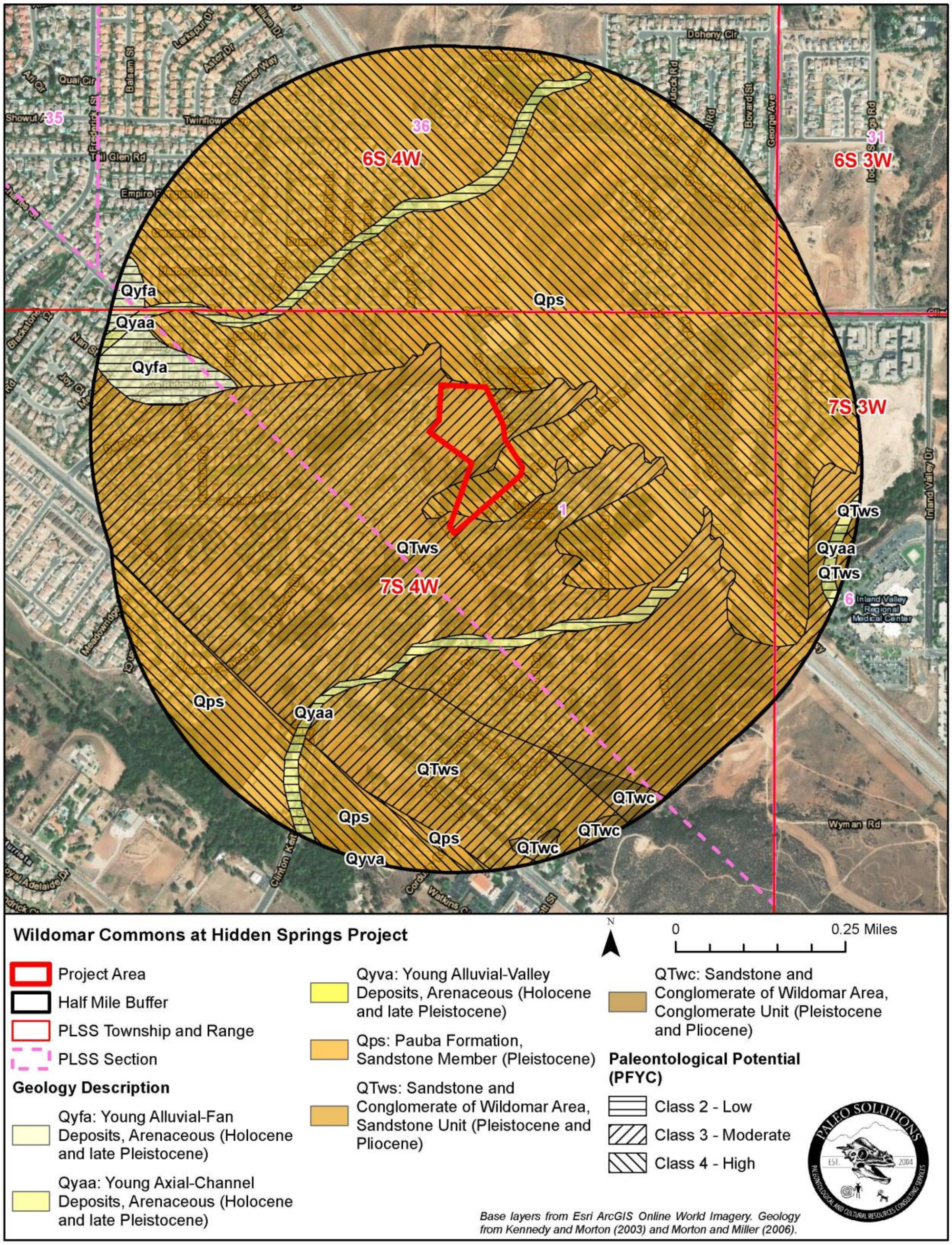

Figure 3. Project geology and paleontological potential.

6.2 PALEONTOLOGICAL RECORD SEARCH RESULTS

Paleo Solutions requested a paleontological record search from the WSC in the City of Hemet, Riverside County, California. The WSC responded on September 5, 2019 that no paleontological resources have been recovered from the Project area or a 1-mile radius, but that numerous fossil localities (referred to as the Principe Collection) had been recovered from Pleistocene-age sediments approximately 5 miles from the Project in Murrieta. Fossils from the Principe Collection include mastodon (*Mammut pacificus*), mammoth (*Mammuthus columbi*), horse (*Equus* sp.), and camel (*Camelops hesternus*) (Radford, 2019; Confidential Appendix A).

Table 3. Paleontological Record Search and Literature Review Summary

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
Principe Collection	Pleistocene-age sediments	*Mammut pacificus* *Mammuthus columbi* *Equus* sp. *Camelops hesertnus*	Mastodon Mammoth Horse Camel	Murrieta, Riverside County	Radford, 2019
UCMP IP6507 - IP6509, B6352	Pleistocene-age sediments	-	Invertebrate	Riverside County	UCMP, 2019
UCMP B4902	Pliocene-age sediments	-	Invertebrate	Riverside County	UCMP, 2019
UCMP P363, UCMP CL31	Pleistocene-age sediments	-	Plant	Riverside County	UCMP, 2019
UCMP V7007	Pleistocene-age sediments	-	Vertebrate	Riverside County	UCMP, 2019
UCMP V6004	Pleistocene-age sediments	-	Vertebrate	Riverside County	UCMP, 2019
UCMP RV8601	Pleistocene-age sediments	Microtinae *Microtus* *Microtus californicus* *Neotoma*	Vole Vole California vole Pack rat	Riverside County	UCMP, 2019
UCMP V7006	Pleistocene-age sediments	*Gopherus*	Gopher tortoise	Riverside County	UCMP, 2019
UCMP V65248	Pleistocene-age sediments	*Mammuthus*	Mammoth	Riverside County	UCMP, 2019
PBDB 200320	Pleistocene-age sediments	*Mammut californicus*	Mastodon	Riverside County	Dooley et al, 2019; PBDB, 2019
Numerous PBDB localities	Pleistocene-age Pauba Formation	Antilocapridae *Capromeryx* sp. *Odocoileus* sp. *Ovis canadensis* *Camelops* sp. *Camelops hesternus* *Hemiauchenia* sp. *Hemiauchenia macrocephala* *Tapirus californicus* *Equus* sp. *Equus scotti* *Mammuthus* sp. *Mammuthus columbi* *Mammut americanum* *Paramylodon* sp. *Paramylodon harlani* *Smilodon fatalis* *Canis latrans* Chiroptera	Pronghorn Pronghorn Deer Big horn sheep Camel Camel Llama Llama Tapir Horse Horse Mammoth Mammoth Mastodon Ground sloth Ground sloth Saber-toothed cat Coyote Bat	Riverside County	PBDB, 2019

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
		Leporidae	Rabbit		
		Lepus sp.	Rabbit		
		Sylvilagus sp.	Rabbit		
		Mustela sp.	Weasel		
		Sorex sp.	Shrew		
		Cricetidae	Rodent		
		Dipodomys sp.	Kangaroo rat		
		Microtus sp.	Vole		
		Microtus californicus	Vole		
		Neotoma sp.	Pack rat		
		Perognathinae	Pocket mouse		
		Peromyscus sp.	Deer mouse		
		Sciuridae	Squirrel		
		Thomomys sp.	Pocket gopher		
		Thomomys bottae	Pocket gopher		
		Scapanus sp.	Mole		
LACM 7261; LACM 5904; LACM 5447; LACM 5464; LACM Unidentified Locality Numbers; SBCM 05.06.229 through 246 and 250 through 258	Pleistocene-age Pauba Formation	Proboscidea	Elephant	Riverside County	Jefferson, 1991
		Mammuthus sp.	Mammoth		
		Mammut americanum	Mastodon		
		Equus sp.	Horse		
		Tapirus sp.	Tapir		
		Cervidae	Deer		
		Bison sp.	Bison		
		Camelops sp.	Camel		
		Hemiauchenia macrocephala	Llama		
		Artiodactyla	Artiodactyl		
		Vulpes sp.	Fox		
		Carnivora	Carnivoran		
		Sylvilagus sp.	Rabbit		
		Sylvilagus audubonii	Rabbit		
		Thomomys sp.	Pocket gopher		
		Thomomys bottae	Pocket gopher		
		Dipodomys sp.	Kangaroo rat		
		Perognathus sp.	Pocket mouse		
		Reithrodontomys sp.	Harvest mouse		
		Neotoma sp.	Pack rat		
		Microtus californicus	Vole		
SBCM 05.006.131, 132, 378, 390, 391, 400, 401, 404, 405, 410 through 412, 414 through 416, 421, 424, 425, 551, 552, 560, 562, 566	Pleistocene-age Pauba Formation	*Mammuthus* sp.	Mammoth	Riverside County	Pajak et al., 1996
		Leporidae	Rabbit		
		Thomomys sp.	Pocket gopher		
		Antilocapridae	Pronghorn		
		Sorex sp.	Shrew		
		Talpidae	Mole		
		Chiroptera	Bat		
		Paramylodon harlani	Ground sloth		
		Sylvilagus sp.	Rabbit		
		Lepus sp.	Rabbit		
		Sciuridae	Squirrel		
		Thomomys bottae	Pocket gopher		
		Perognathus sp.	Pocket mouse		
		Dipodomys sp.	Kangaroo mouse		
		Peromyscus sp.	Deer mouse		
		Neotoma sp.	Pack rat		
		Microtus sp.	Vole		
		Canis latrans	Coyote		
		Mustela sp.	Weasel		
		Smilodon fatalis	Saber-toothed cat		
		Carnivora	Carnivoran		
		Mammut americanum	Mastodon		

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
		Equus sp.	Horse		
		Equus bautistensis	Horse		
		Tapirus californicus	Tapir		
		Ovis canadensis	Big horn sheep		
		Tayassuidae	Peccary		
		Camelops sp.	Camel		
		Odocoileus sp.	Deer		
		Antilocapra sp.	Pronghorn		
		Scapanus sp.	Mole		
SBCM 05.006.072, 076, 078, 083 through 085, 089, 090, 135, 138, 143, 145, 146, 148, through 151, 154 through 159, 184 through 187, 189, 196, 203, 204, 207, 208, 296, 299, 300, 301, 303, 305, 307, 309 through 313, 315, 319, 321 through 324, 341 through 346, 350, 351, 353, 354, 364 through 366, 380 through 386, 394, 397, 539, 540, 545 through 549, 553, 556, 557, 593, 594, 596, 598 through 604, 606, 607, 609 through 616, 619	Pleistocene- to late Pliocene-age Unnamed Sandstone Localities (i.e., Sandstone and Conglomerate of the Wildomar Area, Sandstone Unit [QTws])	Leporidae	Rabbit	Riverside County	Pajak et al., 1996
		Sciuridae	Squirrel		
		Thomomys sp.	Pocket gopher		
		Thomomys bottae	Pocket gopher		
		Perognathus sp.	Pocket mouse		
		Paraneotoma fossilis	Pack rat		
		Sigmodon sp.	Cotton rat		
		Sigmodon minor	Cotton rat		
		Peromyscus sp.	Deer mouse		
		Equus sp.	Horse		
		Equus bautistensis	Horse		
		Neotoma sp.	Pack rat		
		Scapanus sp.	Mole		
		Dipodomys sp.	Kangaroo rat		
		Lepus sp.	Rabbit		
		Sylvilagus sp.	Rabbit		
		Ondatra sp.	Muskrat		
		Mimomys sp.	Vole		
		Mimomys parvus	Vole		
		Prodipodomys sp.	Kangaroo rat		
		Microtus sp.	Vole		
		Microtus californicus	Vole		
		Microchiroptera	Bat		
		Perognathinae	Pocket mouse		
		Onychomys torridus	Grasshopper mouse		
		Vulpes macrotis	Fox		
		Canis latrans	Coyote		
		Camelops sp.	Camel		
		Odocoileus sp.	Deer		
		Megalonyx wheatleyi	Ground sloth		
		Hypolagus sp.	Rabbit		
		Eutamias sp.	Chipmunk		
		Spermophilus beecheyi	Ground squirrel		
		Geomys sp.	Pocket gopher		
		Reithrodontomys sp.	Harvest mouse		
		Coendou sp.	Porcupine		
		Mustela sp.	Weasel		
		Platygonus bicalcaratus	Peccary		
		Tetrameryx sp.	Pronghorn		
		Antilocapra sp.	Pronghorn		
		Camelidae	Camel		
		Canidae	Wolf		
		Canis sp.	Wolf		
		Felidae	Cat		
		Cricetidae	Vole		
		Mammut sp.	Mastodon		
		Mammuthus sp.	Mammoth		
		Arctodus simus	Short-faced bear		
		Hemiauchenia sp.	Llama		
		Taxidea sp.	Badger		

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
		Proboscidea Cervidae Antilocapridae *Paramylodon harlani*	Elephant Deer Pronghorn Ground sloth		
Numerous PBDB localities	Pleistocene- to Pliocene-age sediments	Antilocapridae *Antilocapra* sp. *Tetrameryx* sp. Cervidae *Odocoileus* sp. *Tapirus californicus* *Platygonus bicalcaratus* Camelidae *Hemiauchenia* sp. *Equus* sp. *Equus scotti* *Mammuthus* sp. *Mammut* sp. *Megalonyx* sp. *Paramylodon* sp. *Paramylodon harlani* Canidae *Canis* sp. *Canis latrans* *Vulpes* sp. *Vulpes velox* Felidae *Arctodus simus* Archaeolaginae Leporidae *Hypolagus* sp. *Lepus* sp. *Sylvilagus* sp. *Mustela* sp. *Mephitis* sp. *Taxidea* sp. Microchiroptera Soricidae *Sorex* sp. Arvicolinae Cricetidae Perognathinae Sciuridae *Dipodomys* sp. *Erethizon* sp. *Geomys* sp. *Microtus* sp. *Microtus californicus* *Microtus meadensis* *Myodes* sp. *Neotamias* sp. *Neotoma* sp. *Ondatra* sp. *Onychomys torridus* *Ophiomys parvus* *Peromyscus* sp. *Prodipodomys* sp. *Reithrodontomys* sp. *Sigmodon* sp. *Sigmodon minor*	Pronghorn Pronghorn Pronghorn Deer Deer Tapir Peccary Camel Llama Horse Horse Mammoth Mastodon Ground sloth Ground sloth Ground sloth Wolf Wolf Coyote Fox Fox Cat Short-faced bear Rabbit Rabbit Rabbit Rabbit Rabbit Weasel Weasel Weasel Bat Shrew Shrew Vole Vole Pocket mouse Squirrel Kangaroo mouse Porcupine Pocket gopher Vole Vole Vole Vole Chipmunk Pack rat Muskrat Grasshopper mouse Vole Deer mouse Kangaroo mouse Harvest mouse Cotton rat Cotton rat	Riverside County	PBDB, 2019

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
		Spermophilus sp.	Ground squirrel		
		Spermophilus beecheyi	Ground squirrel		
		Thomomys sp.	Pocket gopher		
		Thomomys bottae	Pocket gopher		
		Thomomys gidleyi	Pocket gopher		
		Scapanus sp.	Mole		
		Aves	Bird		
		Colubridae	Snake		
		Natricinae	Snake		
		Crotalus sp.	Rattlesnake		
		Anguidae	Lizard		
		Iguanidae	Lizard		
		Lacertilia	Lizard		
		Anniella sp.	Legless lizard		
		Eumeces sp.	Skink		
		Gerrhonotus sp.	Alligator lizard		
		Phrynosoma sp.	Horned lizard		
		Sceloporus sp.	Spiny lizard		
		Uta stansburiana	Side-blotched lizard		
		Geochelone sp.	Star tortoise		
		Emydinae	Turtle		
		Testudines	Turtle		
		Plethodontinae	Salamander		
		Anura sp.	Frog		
		Hyla sp.	Frog		
		Bufo sp.	Toad		
		Gasterosteus aculeatus	Stickleback fish		
		Succinea sp.	Amber snail		

7.0 FIELD SURVEY

The Project area is located west of I-15, along Clinton Keith Road, between Hidden Springs Road and Stable Lanes Road in the City of Wildomar, County of Riverside. The terrain consists of low to moderate relief with small rolling hills and a drainage trending northeast to southwest (Figure 4 and Figure 5). Groundcover consists of disked sediments or vegetation with tall grasses; woodland vegetation is present along the drainage (Figure 6 and Figure 7). Existing disturbances consists of a concrete and steel stairway, a drainage west of Hidden Springs Road, broken concrete, and existing privacy fencing along the residential area to the northwest.

Paleo Solutions conducted a paleontological survey of the Project area on August 15, 2019. The results of the field survey are incorporated into the following Geology and Paleontology subsections (Sections 7.1 and 7.2, respectively).

7.1 GEOLOGY

The Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws) is mapped in majority of the Project area and was observed by field staff in exposures to the north of the Project area. It consists of dark reddish-brown weathering to light reddish-orange and brown, poorly sorted, poorly lithified, angular and subrounded, fine-, coarse-, and very coarse-grained sand with granules, pebbles, and cobbles (Figure 8). Observed outcrops of the Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws) were approximately nine feet thick.

The Pleistocene-age Pauba Formation, Sandstone Member (Qps) is mapped in the southern portion of the Project area. However, it was not observed by field staff during the survey. Moreover, geologic units mapped within a half-mile of the Project area, including Holocene- and late Pleistocene-age young alluvial-valley deposits, arenaceous (Qyva), young axial-channel deposits, arenaceous (Qyaa), and young alluvial-fan deposits, arenaceous (Qyfa) and Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Conglomerate Unit (QTwc) were also not observed within the Project area during the survey.

7.2 PALEONTOLOGY

No paleontological resources were discovered during the survey, although sediments conducive to fossil preservation were observed within the Project area; specifically, the Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws).

Figure 4. Overview of the Project area showing low to moderate relief terrain. View west.

Figure 5. Overview of the Project area from top of the hill, showing vegetation and the drainage in the distance. View to the south.

Figure 6. Overview of the Project area with the wooded drainage and disked field. View north.

Figure 7. Overview of the Project area showing topography and wooded drainage. View south.

Figure 8. Exposure of the Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws).

8.0 IMPACTS TO PALEONTOLOGICAL RESOURCES

Impacts on paleontological resources can generally be classified as either direct, indirect or cumulative. Direct adverse impacts on surface or subsurface paleontological resources are the result of destruction by breakage and crushing as the result of surface disturbing actions including construction excavations. In areas that contain paleontologically sensitive geologic units, ground disturbance has the potential to adversely impact surface and subsurface paleontological resources of scientific importance. Without mitigation, these fossils and the paleontological data they could provide if properly recovered and documented, could be adversely impacted (damaged or destroyed), rendering them permanently unavailable to science and society.

Indirect impacts typically include those effects which result from the continuing implementation of management decisions and resulting activities, including normal ongoing operations of facilities constructed within a given project area. They also occur as the result of the construction of new roads and trails in areas that were previously less accessible. This increases public access and therefore increases the likelihood of the loss of paleontological resources through vandalism and unlawful collecting. Human activities that increase erosion also cause indirect impacts to surface and subsurface fossils as the result of exposure, transport, weathering, and reburial.

Cumulative impacts can result from incrementally minor but collectively significant actions taking place over a period of time. The incremental loss of paleontological resources over time as a result of construction-related surface disturbance or vandalism and unlawful collection would represent a significant cumulative adverse impact because it would result in the destruction of non-renewable paleontological resources and the associated irretrievable loss of scientific information.

Excavations may extend several feet below the current ground surface within the Project area for construction of the seven commercial buildings, five detention basins, and the parking areas. Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit (QTws), which has a moderate paleontological potential (PFYC 3), was observed at the surface during the paleontological field survey and had approximately nine feet of exposure. Although the Pleistocene-age Pauba Formation, Sandstone Member (Qps), which has a high paleontological potential (PFYC 4), was not observed during the survey, this geologic unit may be encountered in the subsurface at shallow depth underneath the disturbed, disked sediments within the southern portion of the Project area. Surface grading or shallow excavations entirely within unmapped Recent artificial fill/previously disturbed sediments (af), which have a low paleontological potential (PFYC 2), are unlikely to uncover significant fossil vertebrate remains; however, they likely shallowly overlie older *in-situ* sedimentary deposits of Pleistocene- to Pliocene-age that have relatively higher paleontological potentials. Therefore, grading and other earthmoving activities may potentially result in significant adverse direct impacts to paleontological resources throughout the entirety of the Project area.

9.0 RECOMMENDATIONS

Based on the potential for Project excavations to impact significant paleontological resources, full-time monitoring is recommended during ground-disturbing activities in geologic units of moderate to high paleontological potential (i.e., Pleistocene- and Pliocene-age Sandstone and Conglomerate of Wildomar Area, Sandstone Unit [QTws] and Pleistocene-age Pauba Formation, Sandstone Member [Qps]). If it is determined that only low paleontological potential unmapped Recent artificial fill/previously disturbed sediments (af) are being impacted, or if sediments are determined to not be conducive to fossil preservation, then monitoring in those areas can be reduced or ceased at the discretion of a Qualified

Paleontologist in consultation with the City. Prior to construction, a Qualified Paleontologist should be retained and a PRIMP should be prepared that outlines paleontological mitigation and unanticipated fossil discovery procedures. Any subsurface bones or potential fossils that are unearthed during construction should be evaluated, recorded, and reported by a Qualified Paleontologist. Paleontological resources determined to be significant, or potentially significant, should be subject to fossil recovery, laboratory preparation and analysis, and museum curation (through a curation agreement with the WSC, or another appropriate repository).

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APPENDIX A: MUSEUM RECORD SEARCH RESULTS

CONFIDENTIAL

WESTERN SCIENCE CENTER

September 5, 2019

Paleo Solutions
Barbara Webster, MS
911 Primrose Ave, Unit N
Monrovia, CA 91016

Dear Ms. Webster,

This letter presents the results of a record search conducted for the Wildomar Commons at Hidden Springs Project in the city of Wildomar, Riverside County, California. The project site is located on north of Clinton Keith Road and west of Hidden Springs Road in Section1, Township 7 South, and Range 4 West, on the Murrieta USGS 7.5 minute quadrangle.

The geologic units underlying the project area are mapped entirely as sandstone units dating to the Pleistocene epoch, including those associated with the Pauba Formation (Kennedy & Morton, 1975-1976, 1993). Pleistocene sandstone units are considered to be of high paleontological sensitivity, and while the Western Science Center does not have localities within the project area or within a 1 mile radius, we do have numerous localities associated with the Principe Collection of Murrieta under 5 miles from the project area and in similarly mapped sediments. The Principe Collection contains Pleistocene fauna including those associated with mastodon (*Mammut pacificus*), mammoth (*Mammuthus columbi*), ancient horse (*Equus sp.*), camel (*Camelops hesternus*) and many more.

Any fossil specimen recovered from the Wildomar Commons at Hidden Springs Project would be scientifically significant. Excavation activity associated with the development of the project area would impact the paleontologically sensitive Pleistocene sandstone units, and it is the recommendation of the Western Science Center that a paleontological resource mitigation program be put in place to monitor, salvage, and curate any recovered fossils from the study area.

If you have any questions, or would like further information about the Principe Collection, please feel free to contact me at dradford@westerncentermuseum.org

Sincerely,

Darla Radford
Collections Manager

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